

# Spray Quality Monitor for Informed Pesticide Applications

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## Background

- Provide real-time data acquisition of measured spray particles within pesticide spray application
- Current methods are costly and not applicable for real-time measurements
- Referencing spray card datasheets in which the Volume Median Diameter (VMD) ASABE S572.1 of a pesticide spray particle is used to classify the spray
- Environmental disturbances and changes in the flow rate of the applicator influences the particle size distribution



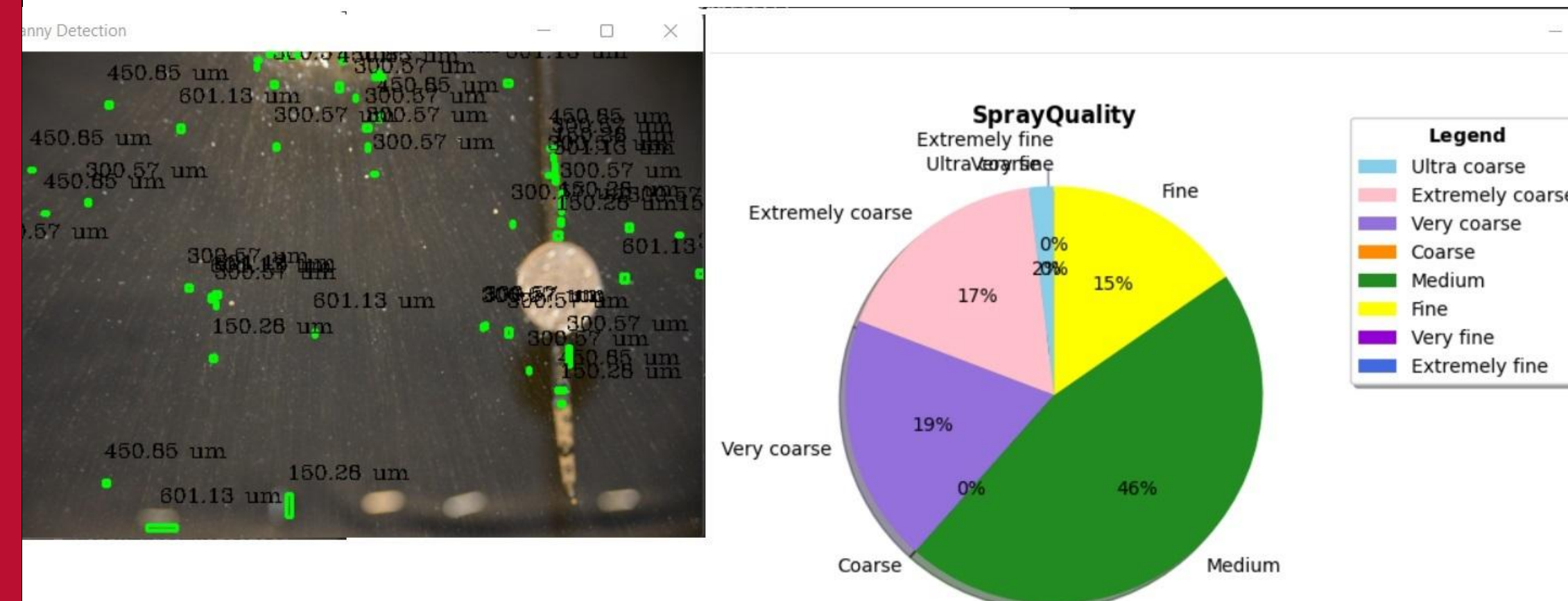
Boom Sprayer

## Goals

- Design affordable accurate device capable of measuring VMD of pesticide spray
- Create software that can measure spray distribution in real time
- Display spray distribution on easy to learn interface
- Display accurate spray quality data to applicators allowing them to make a more informed decision while applying

## Progress

- Test stand capable of recreating pesticide spray
- Determined our design direction through design matrices
- Researched all current designs to gain information on best approach
- Researched and tested the best camera with best lens
- First camera ordered shutter speed was not fast enough to capture individual droplets without blur
- Second camera is monochromatic which increases the processing rate
- Quarter was used to determine the conversion factor in pixels per inch



Canny Edge Detection Program

## Materials

- MCP3008 - 8-Channel 10-Bit ADC With SPI Interface
- Raspberry Pi 4 Model B - 2 GB RAM
- DS18B20 Digital temperature sensor + extras
- Anemometer Wind Speed Sensor w/Analog Voltage Output
- Raspberry Pi HQ Camera
- 16mm 10MP Telephoto Lens
- Full Sized breadboard
- Assembled Pi T-Cobbler Plus - GPIO Breakout - Pi A+, B+, Pi 2/3/4, Zero
- Aluminum Heat Sink for Raspberry Pi 3 or 4 - 15 x 15 x 15mm
- 5V 1A (1000mA) USB port power supply - UL Listed
- USB cable - USB A to Micro-B - 3 foot long
- SD/MicroSD Memory Card (8 GB SDHC)
- TeeJet Red Acetal-Stainless Steel Even Flat Spray Tip Nozzle
- Break-away 0.1" 2x20-pin Strip Dual Male Header

## Images



Prototype Setup



Test Stand Setup

	PSI	100WPK	TT	TT60	ASR	ASR70	ASR70	100WPK	TT	TT60	GPM	4	6	7
015	20	F	C	—	VC	VC	—	—	UC	0.11	8.2	6.5	5.4	4.7
ASR70 TT1	30	F	C	—	VC	VC	—	—	UC	0.13	9.7	7.7	6.4	5.5
ASR70 TT1	40	F	M	—	M	C	—	—	UC	0.15	11.1	8.9	7.4	6.4
ASR70 TT1	50	F	M	—	M	M	—	—	UC	0.17	12.6	10.1	8.4	7.2
ASR70 TT1	60	F	M	—	M	M	—	—	UC	0.18	13.4	10.7	8.9	7.6
ASR70 TT1	70	—	—	—	M	M	—	—	UC	0.20	14.9	11.9	9.9	8.5
ASR70 TT1	80	—	—	—	M	M	—	—	UC	0.21	15.6	12.5	10.4	8.9
ASR70 TT1	90	—	—	—	M	M	—	—	UC	0.23	17.1	13.7	11.4	9.8
02	20	F	VC	C	VC	VC	VC	VC	UC	0.14	10.4	8.3	6.9	5.9
ASR70 TT1	30	F	C	C	VC	VC	VC	VC	UC	0.17	12.6	10.1	8.4	7.2
ASR70 TT1	40	F	M	M	C	C	C	VC	UC	0.20	14.9	11.9	9.9	8.5
ASR70 TT1	50	F	M	M	M	C	C	VC	UC	0.22	16.3	13.1	10.9	9.3
ASR70 TT1	60	F	M	M	M	M	C	VC	UC	0.24	17.8	14.3	11.9	10.2
ASR70 TT1	70	—	—	—	M	M	M	VC	UC	0.26	19.3	15.4	12.9	11.0
ASR70 TT1	80	—	—	—	M	M	M	VC	UC	0.28	21	16.6	13.9	11.9
ASR70 TT1	90	—	—	—	M	M	M	VC	UC	0.30	22	17.8	14.9	12.7
025	20	M	VC	C	VC	VC	VC	VC	UC	0.16	13.4	10.7	8.9	7.6
ASR70 TT1	30	F	C	C	VC	VC	VC	VC	UC	0.22	16.3	13.1	10.9	9.3
ASR70 TT1	40	F	M	M	C	C	C	VC	UC	0.25	18.6	14.9	12.4	10.6
ASR70 TT1	50	F	M	M	M	C	C	VC	UC	0.28	21	16.6	13.9	11.9
ASR70 TT1	60	F	M	M	M	M	C	VC	UC	0.31	23	18.4	15.3	13.2
ASR70 TT1	70	—	—	—	M	M	M	VC	UC	0.33	25	19.6	16.3	14.0
ASR70 TT1	80	—	—	—	M	M	M	VC	UC	0.35	26	21	17.3	14.9
ASR70 TT1	90	—	—	—	M	M	M	VC	UC	0.38	28	23	18.8	16.1
03	20	M	VC	C	VC	VC	VC	VC	UC	0.21	15.6	12.5	10.4	8.9
ASR70 TT1	30	F	C	C	VC	VC	VC	VC	UC	0.26	19.3	15.4	12.9	11.0
ASR70 TT1	40	F	C	C	VC	VC	VC	VC	UC	0.30	22	17.8	14.9	12.7
ASR70 TT1	50	F	M	M	C	C	C	VC	UC	0.34	25	20	16.8	14.4
ASR70 TT1	60	F	M	M	M	C	C	VC	UC	0.37	27	22	18.3	15.7
ASR70 TT1	70	—	—	—	M	M	M	VC	UC	0.40	30	24	19.8	17.0
ASR70 TT1	80	—	—	—	M	M	M	VC	UC	0.42	31	25	21	17.8
ASR70 TT1	90	—	—	—	M	M	M	VC	UC	0.45	33	27	22	19.1

Nozzle Selection Chart



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